

REMARKS

Claims 10 to 21 are retained unamended and claims 1 to 9, which were non-elected, have been canceled.

Claims 10 to 13 and 16 to 18 were rejected under 35 U.S.C. 103(a) as being unpatentable over Zekeriya et al. (U.S. 6,607,962) in view of Chan. The rejection is respectfully traversed.

As stated in the specification, thin film resistors are very attractive components for high precision analog and mixed signal applications. In addition to a low thermal coefficient of resistance and low voltage coefficient of resistance, thin film resistors provide good resistor matching and good stability under thermal stress. To achieve good stability under thermal stress, it is critical to not only control the resistance of the body of the thin film resistor, but also the resistance of the electrical interface layer to the thin film resistor. Ideally, the resistance of the electrical interface layer should not contribute to the resistance of the thin film resistor. Typically, thin film resistor fabrication processes implement titanium tungsten (TiW) as an electrical interface layer to the thin film resistor layer. A disadvantage associated with using titanium tungsten (TiW) as the electrical interface layer to the thin film resistor layer is that titanium tungsten (TiW) contributes to the overall resistance associated with the thin film resistor layer. In other words, the resistivity of the thin film resistor is not well controlled by the titanium tungsten (TiW) electrical interface layer, and contributes to increased thermal stress and an increased thermal coefficient of resistance (TCR) of the thin film resistor. Another disadvantage associated with using titanium tungsten (TiW) as an electrical interface layer

is high particulate levels, as well as maintenance issues associated with the high particulate levels.

The present invention relates to a thin film resistor (TFR) structure and a method of fabricating a TFR structure which includes an electrical interface layer or head layer that is a combination of a titanium (Ti) layer and a titanium nitride (TiN) layer. The combination of the Ti layer and the TiN layer provides a lower particulate interface to the thin film resistor and a relatively low resistance associated with the electrical interface layer of the TFR structure.

Claim 10 requires, in addition to other steps, the steps of forming a layer of titanium (Ti) over the first and second TFR vias, and forming a layer of titanium nitride (TiN) on the Ti layer, the layer of Ti and the layer of TiN forming a first electrical interface portion to the first end of the TFR and a second electrical interface portion to the second end of the TFR. No such steps are taught or even remotely suggested by Zekeriya et al. as admitted. With reference to Chan at col. 4, lines 62 to 65, though two separate layers of Ti and TiN are discussed, note that the via is not over the end of the TFR, but rather to the side of the TFR. It follows that not only is the two layer structure of Chan not for the same purpose as in the subject invention, but, in addition, there can be no suggestion to combine the references since the Ti/TiN layers of Chan are not disposed over the end of the TFR. As stated above, the purpose of the invention is to replace the TiW diffusion barrier/head material of the prior art with the two layer structure involving Ti:TiN to provide a lower particulate, lower resistive interface to the thin film resistor. Nowhere in Chan is the two layer structure utilized for this purpose and there is not teaching or suggestion in Chan or Zekeriya et al. to substitute the two layer structure of

Chan into the structure of Zekeriya et al. It therefore follows that the suggestion to combine the references is taken from the subject disclosure and not from the prior art.

Claims 11 to 13 and 16 to 18 depend from claim 10 and therefore define patentably over the applied references for at least the reasons presented above with reference to claim 10.

Claims 14, 15 and 19 to 21 were rejected under 35 U.S.C. 103(a) as being unpatentable over Zekeriya et al. in view of Chan or Ohkawa further in view of Lammert (U.S. 6,475,400). The rejection is respectfully traversed.

Each of these claims require the steps discussed above with reference to claim 10. Lammert in no way overcomes this deficiency.

In view of the above remarks, favorable reconsideration and allowance are respectfully requested.

Respectfully submitted,



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